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| **Lesson Title: Pedigrees and Your family tree** |
| **Subject area / course / grade level:** Genetics and biotechnology/ biology/5 and 6 |
| 1. **Introduction:** Heritable traits, those encoded by individual genes and passed from parent to child, result in one of two appearances (dominant or recessive). Each parent starts with two versions of each gene (alleles), but passes only one to any child. Here there are two versions of each gene and we use letters to tell them apart (A and a). Capital letters represent “dominant genes,” while lowercase letters represent “recessive genes.” The dominant version of the gene will mask over the recessive version, so anyone with one of each will appear to have the dominant version of the trait. So, if you are recessive, you know your genes are ‘aa,’ but if you are dominant, you don’t know if you are AA or Aa. We usually write that as A\_. Not all appearances can be inherited, such as scars. A diagram-type way of looking at how genes and appearances (phenotype) are passed from one generation to the next is a pedigree, like a family tree. By combining pedigrees and the knowledge that each parent contributes one version of a gene to a child, pedigrees can be used to predict which genes parents and/or children have. In addition, it can also be used to predict the appearance of an unborn child. |
| **Lesson Length:** 2 blocks of 30 minutes |
| **Materials:** handout**,** paper and pencil, may use taste papers for PTC, sodium benzoate, and thiourea |
| **Lesson Overview:**  This lesson uses observation of heritable traits and the knowledge that each parent contributes genetic information to create a diagram representing a family tree. An example tree (pedigree) is then used to predict the specific genes transmitted. |
| **Tennessee Standards:**  GLE0507.Inq3, GLE0507.4.1, GLE0507.4.2  GLE06070607.Inq3 |
| **Lesson objective(s):**  Students will learn that each heritable trait results from genes that each parent gave the offspring  Students will learn that for these traits there are two gene versions (alleles), but only two outward appearances (dominant and recessive).  Students will learn to make predictions for individuals whose genes are not known for certain |
| **ENGAGEMENT**   * Describe how the teacher will capture students’ interest.   Personalization: Instructor uses the genetic traits list to help students determine their own heritable characteristics. Students use their own families to create “genetic” family trees (pedigrees).   * What kind of questions should the students ask themselves after the engagement?   What does a pedigree of my family look like for a different trait?  How do I put \_\_\_\_\_\_ in my pedigree? [usually half-siblings or step-siblings] |
| **EXPLORATION**   * Describe what hands-on/minds-on activities students will be doing.   Students will determine their own genetic traits and their possible genes. Students will use their own family information to construct a pedigree using one heritable trait. In addition, students will use a given pedigree to figure out the genes passed from parent to child.   * List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration   How could you tell the difference in a trait that is passed from parent to child from one that isn’t?  Pick any particular child within the pedigree and ask about what versions of each gene were given by each parent. |
| **EXPLANATION**   * Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination?   What features do you have that are like those in your family?  If you were to create a family tree just using that feature, what would it look like?   * List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.   What if you had this appearance, what would be your genes?  If you have these genes, what would be your appearance?  If the pedigree looked like this, what would be your conclusion for this child or that parent?  How could you do an experiment to see if tattoos were heritable? |
| **ELABORATION**   * Describe how students will develop a more sophisticated understanding of the concept.   They will be using logic and diagrammatic tools to determine which genes were given to a child from each parent. They will be asked to use their own families to construct pedigrees and perform analyses.   * What vocabulary will be introduced and how will it connect to students’ observations?   Dominant trait – the version of a trait that shows in a person with one dominant and one recessive gene  Recessive trait – the version of a trait that only shows there is no dominant gene version present  Dominant gene – the version of a gene that will show in the appearance regardless of what other gene is present  Recessive gene – the version of a gene whose appearance can be masked by a dominant version  Heritable – a trait that is passed from one generation to another via genes  Phenotype – the physical appearance of a trait; it is determined by the individual’s genes and can be a behavior as well.   * How is this knowledge applied in our daily lives?   This information is used in counseling situations when dealing with genetic disease such as cystic fibrosis, sickle cell anemia, and blood clotting disorders. It is also used to predict the appearance of an unborn child. |
| **EVALUATION**   * How will students demonstrate that they have achieved the lesson objective?   They should be able to construct a pedigree for their own family and make an accurate prediction of their own inheritance pattern. In addition, the student should be able to solve for genes in certain “unknown” individuals in a given pedigree.   * This should be embedded throughout the lesson as well as at the end of the lesson |

Intro to heredity

<http://teach.genetics.utah.edu/content/heredity/>

<http://learn.genetics.utah.edu/>

Family history

<http://learn.genetics.utah.edu/content/health/history/>

traits – lots of activities

<http://learn.genetics.utah.edu/content/begin/traits/activities/>

(including doggie DNA)

<http://learn.genetics.utah.edu/content/begin/traits/activities/pdfs/Traits%20Bingo_Public.pdf>

And traits vs. traditions

<http://learn.genetics.utah.edu/content/begin/traits/activities/pdfs/Traits%20and%20Traditions_Public.pdf>

1. The Genes of You

|  |  |  |
| --- | --- | --- |
| **Genetic Trait** | **Your appearance**  **(dominant or recessive)** | **Your possible genes**  **(AA, Aa, aa, or A\_)** |
| Hairline  (widow’s peak or straight) |  |  |
| Tongue rolling  (ability or not) |  |  |
| Little finger shape  (bent or straight) |  |  |
| Hitchhicker’ thumb  (straight or angle) |  |  |
| Hand clasping  (left on top or right on top) |  |  |
| Earlobe attachment  (free or attached) |  |  |
| PTC  (taste or not) |  |  |
| Sodium benzoate  (taste or not) |  |  |
| Thiourea  (taste or not) |  |  |

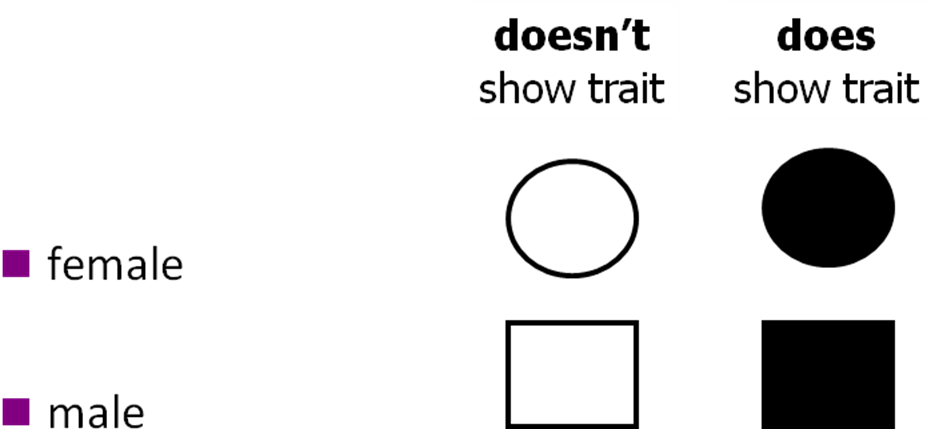
a. Dominant versions of the traits are listed on the left and the recessive version of the trait is on the right. Complete the table by circling which version of each trait you have.

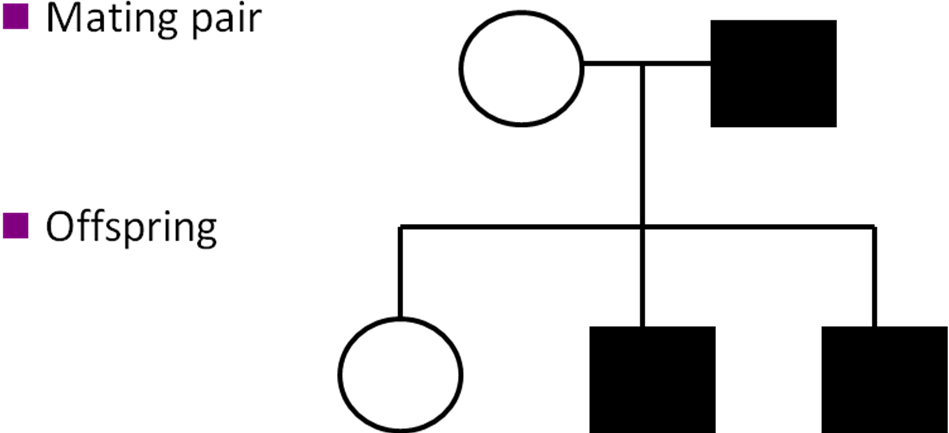
b. There are two versions of each gene and we use letters to tell them apart (A and a). Capital letters are “dominant genes,” while lowercase letters are “recessive genes.” A person receives one gene (one letter) from mom and the other from dad for a grand total of two genes. The dominant version of the gene will mask over the recessive version, so anyone with one of each will appear to have the dominant version of the trait. Complete the first blank column to show whether you have the dominant or recessive version of each trait.

c. So, if you are recessive, you know your genes are ‘aa,’ but if you are dominant, you don’t know if you are AA or Aa. We usually write that at A\_. Complete the second column in the table to determine your possible genes for each trait.

d. These traits are passed down from parent to child. Think of some appearance that a parent doesn’t pass to a child.

2. Pick a heritable trait from above and use the diagrams below to draw your family tree.



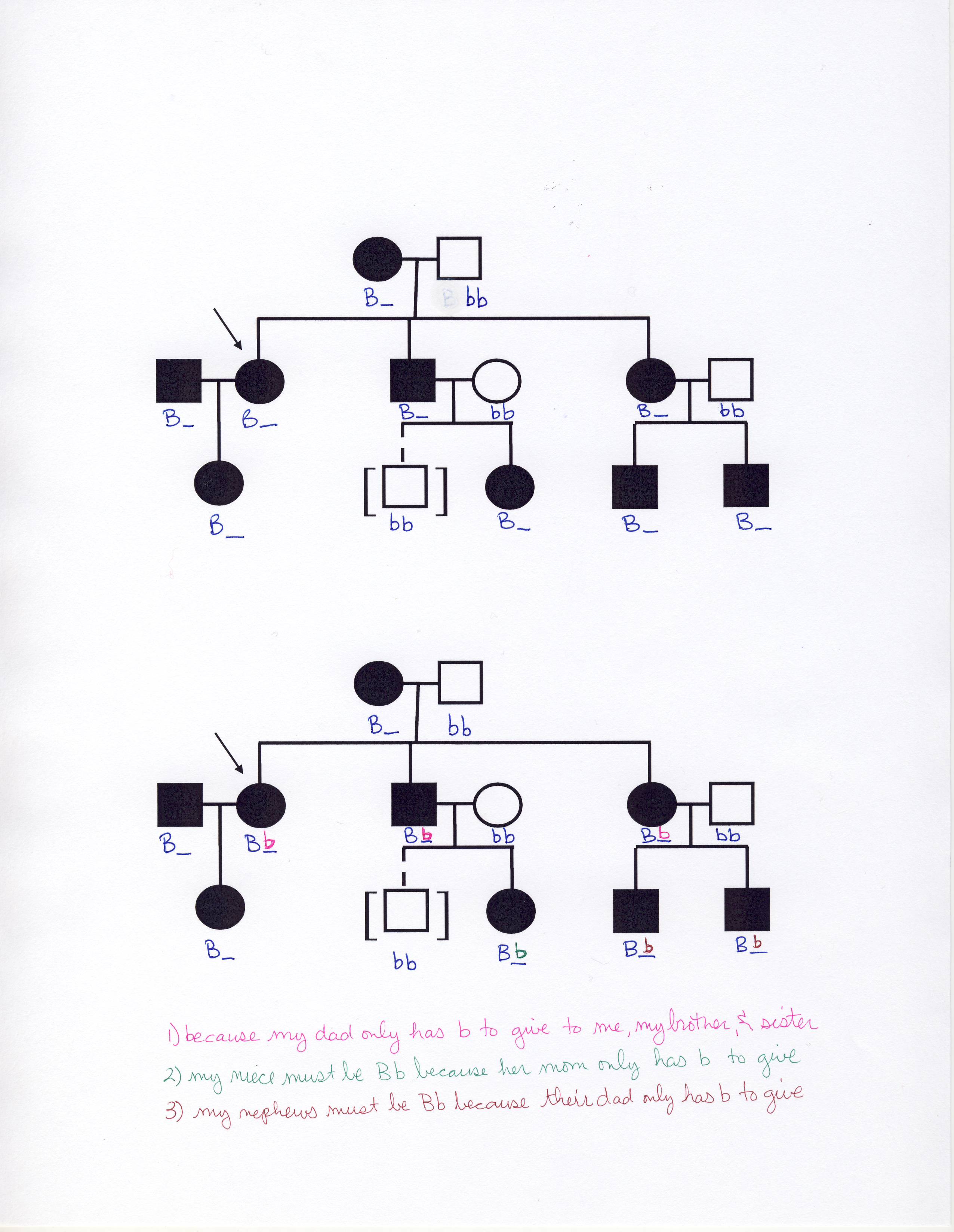


3. Bent little finger (dominant)

Use this family to determine which versions of the gene each person has, when possible.

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KEY:



Other relationships that students may ask about:

